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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/820,695	03/30/2001	Si Yi Li	015290-500	4162

7590

09/24/2003

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EXAMINER

OLSEN, ALLAN W

ART UNIT

PAPER NUMBER

1763

DATE MAILED: 09/24/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

AS

Office Action Summary	Application No.	Applicant(s)	
	09/820,695	LI ET AL.	
	Examiner	Art Unit	
	Allan W. Olsen	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 30 March 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>12/12/01</u>
<u>7/12/01</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, and by virtue of dependency claims 2-20, recite the limitation "...etching exposed portions of the organosilicate layer...". There is insufficient antecedent basis for an organosilicate layer.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1, 3-7, 11 and 13-17 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. patent 6,248,149 issued to Li et al. (hereinafter, Li).

Li teaches plasma etching a low-k dielectric layer such as BCB. Li teaches using an etchant comprising a fluorocarbon and a greater amount of nitrogen (column 5, lines 39-40; column 10, lines 21-23; column 11, lines 34-35). Li teaches etching a layer (16) of BCB through an overlying patterned layer of SiN (18). The patterned SiN functions as a mask for the subsequent etching of the underlying layer of BCB (see figures 5 and 6; column 6, line 56 -

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column 7, line 31). Li teaches a BCB: SiN etching selectivity of 35:1 (column 11, lines 56-57). Li teaches etching a layer of BCB that is disposed upon an underlying layer (14) of SiN. C₄F₈ and CH₂F₂ are among the fluorocarbons etchants that Li teaches (column 14, lines 44-45). Li teaches etching a layer of BCB that overlies a copper conductive feature (12) (figure 5; column 6, line 59). Li teaches etching patterns with features as small as 0.2 microns (column 15, line 60). Li teaches using a fluorocarbon flow rates that is less than 30% of the nitrogen flow rate (column 11, lines 34-35). Li teaches applying an RF bias power to the substrate during the etching process (column 11, line 37-38). Li teaches the method is part a damascene process and the etched feature is filled with metal (column 8, lines 6-8).

Claims 1-6, 9, 11, 12 and 14-16 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. patent 6,455,411 issued to Jiang et al. (hereinafter, Jiang).

Jiang teaches plasma etching a low-k dielectric layer. Jiang teaches using an etchant comprising a fluorocarbon and a greater amount of nitrogen. Jiang teaches etching low-k dielectric layers (106 and 108) through an overlying patterned layer of SiN (capping layer 110). The patterned SiN functions as a mask for the subsequent etching of the underlying layer of low-k dielectric. Jiang teaches etching a layer of low-k dielectric that is disposed upon an underlying layer of SiC (104). C₄F₈, C₄F₆, and CH₂F₂ are among the fluorocarbons etchants that Jiang teaches. Jiang teaches adding Ar to the etchant. Jiang teaches etching a layer of low-k dielectric material that overlies a barrier layer comprising TaN. Jiang teaches using a fluorocarbon flow rates that is less than 30% of the nitrogen flow rate. Jiang teaches the etched feature is filled with metal. See: column 2, lines 56-58; column 2, line 65 - column 3, line 26; column 3, lines 33-63; column 4, lines 1-2, 26-46.

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Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 8-10, 12, 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li.

The teachings of Li, as noted above, are herein relied upon.

Li does not teach using a mixture of C₄F₈ and CH₂F₂. Li does not teach the use of an inert carrier gas. Li does not teach a nitrogen flow rate of between 50 sccm and 300 sccm. Li does not teach a chamber pressure of between 50 mTorr and 500 mTorr. Li does not teach a substrate support temperature of 20° C to 50° C.

It would have been obvious to one skilled in the art to use a mixture of C₄F₈ and CH₂F₂ as the fluorocarbon component of Li etchant because Li teaches that C₄F₈ and CH₂F₂ may each be used individually and "[i]t is prima facie obvious to combine two compositions each of which is taught by the prior art to be useful for the same purpose, in order to form a third composition which is to be used for the very same purpose."

In re Kerkhoven 205 USPQ 1069 (CCPA 1980). Cites *In re Susi* 169 USPQ 423, 426 (CCPA 1971); *In re Crockett* 126 USPQ 186, 188 (CCPA 1960). See also *Ex parte Quadranti* 25 USPQ 2d 1071 (BPAI 1992).

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It would have been obvious to one skilled in the art to use an inert carrier gas because incorporation of a carrier or diluent was held to have been obvious.

In re Lerner 169 USPQ 51 (CCPA 1971); *In re Rosicky* 125 USPQ 341 (CCPA 1960).

It would have been obvious to one skilled in the art to appropriately adjust the process parameters, including temperature, pressure and flow rates, for each of the various types of plasma reactor systems that Li teaches may be used. For example, when using the a capacitively coupled plasma reactor system one would generally use a higher pressure and flow rates than those taught by Li because capacitively coupled reactors generally operate at higher chamber pressures and with higher gas flow rates. Furthermore, the selection of reaction parameters such as temperature and concentration are considered to be obvious:

"Normally, it is to be expected that a change in temperature, or in concentration, or in both, would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation."

In re Aller 105 USPQ 233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Additionally, concentration limitations are obvious absent a showing of criticality.

Akzo v. E.I. du Pont de Nemours 1 USPQ 2d 1704 (Fed. Cir. 1987).

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Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jiang.

The teachings of Jiang, as noted above, are herein relied upon. Additionally it is noted that Jiang teaches an etchant consisting of C4F8, N2 and Ar.

Jiang does not teach using an etchant that consist essentially of C5F8, N2 and Ar.

It would have been obvious to one skilled in the art to use an etchant consisting of C5F8, N2 and Ar because Jiang teaches using an etchant consisting of C4F8, N2 and Ar and Jiang also teaches that C4F8 and C5F8 are functional equivalents as the fluorocarbon component of the etchant mixture. The substitution of equivalents is obvious and requires no express motivation as long as the prior art recognizes the equivalency.

In re Fount 213 USPQ 532 (CCPA 1982); *In re Siebentritt* 152 USPQ 618 (CCPA 1967); *Graver Tank & Mfg. Co. Inc. v. Linde Air Products Co.* 85 USPQ 328 (USSC 1950).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Allan Olsen whose telephone number is 703-306-9075. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Greg Mills, can be reached on 703-308-1633.

The general fax numbers for TC1700 are 703-872-9310 (non-after finals) and 703-872-9311(after-final).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0661.

Allan Olsen, Ph.D.
September 15, 2003

A handwritten signature in black ink, appearing to read "Allan Olsen", is written over the typed name and date.